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An auditory discrimination procedure was used in this study to attempt to correct the speech problem of a 4-year-old girl. The major characteristic of that speech problem was the consistent use of inappropriate first consonant sounds in some words, like "gog" for "dog." The child was given 25 training sessions and two posttraining sessions. The first three training sessions involved ascertaining which of 45 stimulus words the subject mispronounced. The 13 words so ascertained were used later in the study. Sessions four and five involved a visual match exercise. Sessions 12 through 15 paired the visual stimuli of the previous exercises with the sounds they represented. Sessions 16 through 25 introduced a fading technique to eliminate the visual stimuli and transfer control of the discrimination to the auditory stimuli. Beginning at the end of sessions eight through 11, the 13 mispronounced words obtained in the first three sessions were introduced as stimulus items. It was found that the child's ability to discriminate "auditorially" between her response and the correct response improved over the sessions but that this discriminative ability did not appear to affect her verbal inability to correctly pronounce the stimulus words. (WD)

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The University of Kansas Head Start Evaluation and Research Center

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II.

"An Investigation of Three Procedures for Modifying the Topography of Verbal Responses."

PS001219

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II A

"A Study of Auditory Discrimination and Verbal Responding"

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A Study of Auditory Discrimination and Verbal Responding[1]

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ABSTRACT

Running Head: Auditory Discrimination and Verbal Responding

A single female S was taught to discriminate auditorially between her incorrect verbal responses and the correct pronunciation of those sounds. The method was to pair the auditory stimuli with visual stimuli and then fade out the visual stimuli. The descriminative training had little effect on the child's verbal responses.

A study of Auditory Discrimination and Verbal Responding

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A widely held hypothesis in the area of speech therapy is that teaching a child who has a speech problem with no organic involvement to hear the difference between the correct pronunciation of a word and his pronunciation will inable him to produce the correct sound. An analysis of problems in pronunciation based on the operant literature would indicate that while the ability to discriminate between sounds is important, it should not be sufficient to correct the speech problem. However, the evidence dealing directly with the problem of whether discriminative training is sufficient to produce the desired change in a subject"s behavior is some what contradictory. Winitz and Preisler (1965) found that after discriminative training a high per centage of their subjects could correctly pronounce a word which they had been unable to pronounce before training. On the negative side, Lane and Schneider (1963) compared a series of methods of producing changes in the pronunciation of a single second language sound. They found that teaching the subjects to discriminate between the correct sound, a Thai Kā, and variations of this sound had no effect on the subjects' ability to produce the correct sound. A third study (Pinsleur 1963) dealing the problem of effects the same problem reported mixed results depending on the sounds being used as the stimuli. The main object of the present study was to examine the effects of extensive discrimination training on the speech problem of a four year old child.

A second concern of the study was the examination of the procedures used to produce an auditory same-different discrimination from a visual same-different discrimination. Fading procedures, similar to those used by Moore and Goldiamond (1964), were used to transfer the control of the discrimination from the visual stimulus complex to the auditory stimulus complex while eliminating the visual stimuli.

METHOD

Subject

The subject of this study was a four year old female child who was attending a preschool ran by the Department of Human Denelopment at the University of Kansas. This child had a variety of speech articulation and pronunciation problems. However, the major characteristic of her speech was that she consistently used inappropriate first consonant sounds such as "gog" for "dog" and "tat" for "cat".

Procedure

The training was conducted 4 days a week Monday through Thursday in the afternoon. Each session lasted approximately 20 minutes.

Reinforcement procedures

A variety of reinforcement procedures were used in an effort to maintain good control over the S's responding. The S was reinforced with

pennies on a crf schedule for correct responses in sessions 1 through 10. The mother agreed to take the child to the store after the daily session so that she could spend her money. In sessions 8, 9, and 10 the child did not appear to be closily attending to the stimuli so the reinforcement procedure was modified slightly. Beginning in session 11 and continuing through session 22, the S was given a penny for each correct response but lost one for each incorrect response.

The S's performance began deteriorating again in sessions 16 through 22, and she was reluctant to come in to the experimental setting. It was found that the mother was no longer taking the child to spend her money. Another change was made in the reinforcement procedures. To remove the inconvenience of the mother taking the child to the store, the child was reinforced with poker chips for correct responses during the session, and immediately afterwards she could trade them for toys and candy. The prices for the candy and toys ranged from 1 token for a piece of candy to 15 tokens for the largest toys. In this manner better performances were paid off at differential rates. This procedure was used for the remainder of the experiment.

Pre discrimination training test of the S's verbal behavior

In order to ascertain the exact nature of the S's speech problems 3 sessions were used to investigate what the S actually said for such words as dog, cat, etc. The child was shown a series of 45 pictures, 15 each session and asked to name them. After the S answered, the E gave the correct pronunciation and asked the S to repeat it. Each picture was presented 3 times in an unsystematic order. The child was reinforced with pennies given for attending to the task and for obeying the E instructions.

Thirteen of the 45 stimulus words to which the S gave consistent incorrect responses were selected to be used as stimuli for the auditory discrimination training. The stimulus words were selected on the basis of analysing tape recordings of the sessions. The types of errors selected wrre those which could be easily discriminated and scored. In 12 of the 13 words selected, the error was a consistent and clear inappropriate first sound, such as "gog" for "dog". The last stimulus word selected was rooster for which the S consistently said "rooker". Again, the error is a single inappropriate sound.

Test of auditory same-different discrimination

The S was given a pair of sounds such as "car"-"gar" by the E and asked if they were the same or different. The S was reinforced for correctly identifying whether the sounds were the same or different. The stimulus pairs used in this procedure were selected on the basis of the child's performance in the pre training procedure. The stimulus pairs were made up of the correct pronunciation and the response that the S consistently made to the picture. The auditory stimulus pairs used during this procedure, the visual and auditory same-different procedure, the visual and auditory same-different fading procedure, and the post training prodedure are summarized in Table 1.

Insert Table 1 here

Visual match to sample

The first four days of the discrimination training consisted of modifications of a visual match to sample procedure. In sessions 4 and 5, the S was presented a stimulus complex on a single card, and told to look at it. Next two maor stimulus cards were presented on either side of the first, and the S was asked to point to the one which matched the one in the middle. When the child responded correctly, she was immediately reinforced and told yes those two are the same. If she responded incorrectly, she was told that those two cards were not the same but the other two cards were the same. Then the next set of cards were presented. The first stimuli were simple geometric shapes such as squares, triangles, and circles. The complexity of the stimuli was gradually increased through the series until at the end of session 5 the stimuli consisted of variations in 3 elements on each card such as 121, 123, 123. In session 6, the S was asked to point to the card that did not match the card in the middle. The S was given a variable task in session 7 being asked on a random basis to point to either the match or the mismatch. The stimuli used in sessions 6 and 7 were a composite of the stimuli from sessions 4 and 5.

Visual same-different

In sessions 8 through 11, the S was presented two stimulus cards which may have had the same or different stimulus complexs on them. The S was then asked if the two cards were the same or different. If the child responded correctly the E told her that was right, they were the same, or different, and gave her the reinforcer. If she responded incorrectly, she was told that she was wrong, and the E explained why her answer was wrong. A similar correction procedure was used during the rest of the experiment. Again the initial stimuli were simple geometric shapes, but they were rapidly increased in complexity until at the end of session 9 the stimuli consisted of visual representations of the pairs of stimulus words used during the auditory discrimination test.

Visual and auditory same-difference

The next step in the discrimination training was to pair the visual stimuli with the sounds they represented. The S was presented pairs of stimulus cards which consisted of the visual representations of the auditory discrimination stimuli. As each stimulus card was presented the E pronounced the stimulus loudly and clearly. Again the S was asked if the stimuli were the same or different. An example of this procedure would be the stimulus pair "dog" - "gog". The card dog would be presented and the E would say, "This says dog." Next the card gog would be presented, the E would say, "This says gog.", and ask the S if they looked and sounded the same or different.

Auditory discrimination probe

In order to find out if the training so far had been successful in developing an auditory same-different discrimination, the S was presented the stimuli from session 1 in exactly the same manner.

Visual and auditory same-different (fading the visual stimulus)

The procedures used in sessions 16 through 25 were similar to those

for sessions 12, 13, and 14 woth two major differences. First, the stimuli were presented on a single card, one printed on the upper half of the card and the other on the lower half. Secondly, beginning with session 17, a fading procedure was used to eliminate the visual stimuli and transfer the control of the discrimination to the auditory stimuli. The fading was done along two dimensions, the darkness of the stimulus figure and the completeness of the stimulus figure. The darkness of the stimulus was faded by changing from making the stimulus with a black marking pen to a black felt tip pen to a black ball point pen to a number 2 drawing pencil. The completeness of the stimulus was manipulated by introducing gaps into the letters so that they were made up of dashes. The gaps were gradually lengthened, the dashes shortened until the stimulus consisted of a series of light dots. In session 25, the visual stimuli had been faded to the point where several adults were unable to make the discrimination on the basis of the visual stimuli. Beginning in session 21, the E asked the S only if the stimuli sounded the same or different.

Auditory same-different

The visual stimuli were completely eliminated, and the S was presented only auditory stimuli. The S was presented the same stimulus pairs that were used in the initial test of auditory discrimination plus a set based on 3 other words to test for generalization. The stimulus pairs were presented in exactly the same manner as in the test of auditory same-different discrimination procedure.

Post discrimination training test of S's verbal behavior

The S was given two sessions of post training testing to ascertain what effect the ability to discriminate between correct and incorrect pronunciation had on the S's verbal responses. The S was presented the pictures of the 13 stimulus pairs used in the final auditory same-different procedure. The procedure was exactly the same as that used in the pre test with the exception of the changes in the reinforcement procedure which were outlined in the reinforcement section.. Pinsleur (1963) analysed his results on the basis of a distinction between discrimination and differentiation. He felt that the cases where the discrimination training was effective, the subjects had the ability to produce the correct sound and the discrimination training merely taught them when to produce it. On the other hand, where the training was ineffective, he felt that it was because the subjects did not have the motor skills necessary to produce that sound. Further, he concluded that the discriminative training which did not operate directly on the subjects motor skills was not sufficient to produce the ability to emitt that sound. This is an appealing hypothesis which may account for the variation in the findings of the Land and Schneider (1963) and Winitz and Preisler (1965) unfortunately, it can not be applied unmodified to the results of the present study. At various times through out the experiment the subject displayed the ability to produce all of the speech sounds that were involved in the discrimination training. The most striking example of this was the consonant sound, "g" which the subject used often and with great accuracy except when the stimulus was "goat" at which time she generally emitted the consonant, "k". It may be that the explanation of the differences in results may be due to a possibly crucial difference

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between the subject populations of the two studies. Pinsleur's subjects were students in a high school French class; while the subject of this study was a four year old child with a wide variety of speech problems. It is likely that we may make an assumption about the behavior of the high school French students which we might not be able to make about this subject, that is, that the behavior of improving French pronunciation was under good reinforcement control. These subjects probably had a long history of "good" classroom behaviors producing reinforcement ie. good grades. It is unlikely that a similar statement about the reinforcement control of improved pronunciation might be made about this subject. Perhaps if this subject's speech were brought under similar reinforcement control, then the discrimination training might have produced the desired results. However, in and of itself discrimination training had little effect on the verbal behavior of this child.

RESULTS AND DISCUSSION

Comparing the scores of the first 3 auditory discrimination sessions with those for the last 3 auditory discrimination sessions shows the improvement in the child's ability to descriminate auditorially between her response and the correct response. At the beginning the discrimination training, the child was responding at chance level on this task; after the discrimination training, the S could accurately tell the difference between her response and the correct pronunciation.

Insert fig. 1 (the graph)

However, this descriminative ability had little effect on her verbal responses. Her responses to the pictures in the post discrimination test remained essentially the same in respect to the inappropriate sounds being measured, as the responses in the pre discrimination with the single exception of the word lamb. The S's initial response to the picture of a lamb was amb. After the discrimination training, she did pronounce lamb correctly. A comparison of the results of the pre-discrimination test with the results of the post-discrimination test is presented in Table 2.

Insert Table 2 here

The difficulty in finding an effective reinforcement procedure made impossible an analysis of which parts of the discrimination procedures were essential to the final development of the child's ability to discriminate between the auditory stimuli. It is likely that the match to sample procedure could have been eliminated with little detramental effect since the scores on it were all fairly high, and the results of the auditory probe showed the S had made no improvement in auditory discrimination to that point.

It was not possible to tell whether the low scores in sessions 19 through 22 were due to reinforcement problems or a function of poor stimulus programming. Further since both the darkness and the completeness of the visual stimuli were faded together an analysis of whether both operations were necessary was not possible. It is likely that the procedures could have been made much shorter and faster without

losing any of their effectiveness.

While there was some difficulty in analysing which parts of the results could be attributed to what factors in the procedures, the overall procedure was clearly successful. The child learned the auditory discrimination, and her performance in other preschool tasks indicated that she had learned a valuable generalized same-different concept.

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Table 1

Stimulus pairs selected from pre discrimination training test.

Correct	S's response
1. Cat	Tat
2. Doll	Goll
3. Kite	Gite
4. Top	Cop
5. Dog	Gog
6. Lamb	Amb
7. Duck	Guck
8. Boat	Coat
9. Swing	Twing
10. Car	Gar
11. Goat	Coat
12. Rooster	Rooker
13. Calf	Taff

There are 4 possible combinations of each stimulus pair, Top-Top, Cop-Top, Cop-Cop, and Top-Cop. All 4 combinations were used in each session that a particular stimulus pair was used to avoid any biasing of the results.

Combinations of the first 10 stimulus pairs were used 4 in each session during the discrimination training procedures and the last 3 stimulus pairs were used in sessions 27, 28, and 29 to test for generalization.

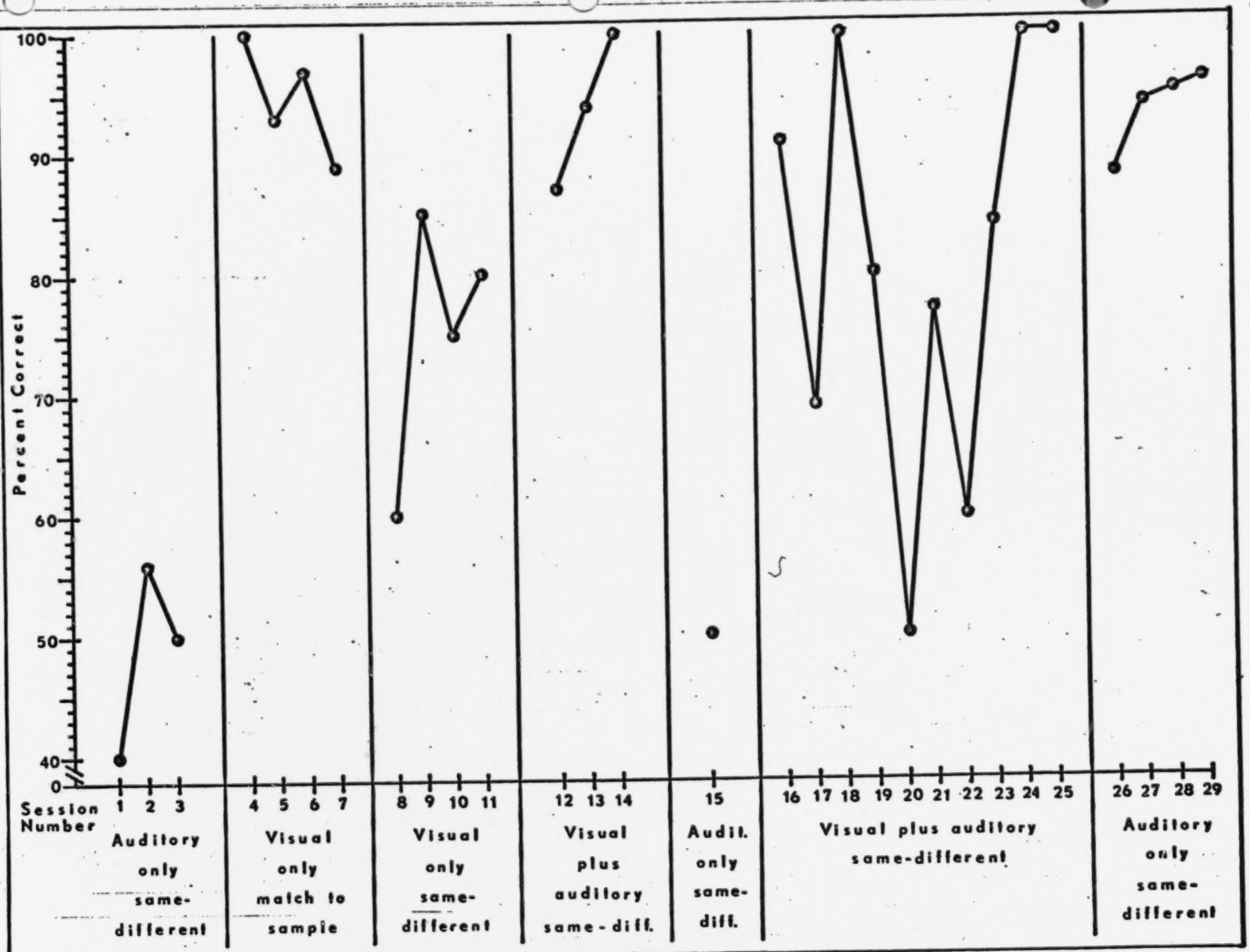
Table 2

Prediscrimination test

Stimulus picture	Response		
Trial	1	2	3
cat	tat	tiddy tat	tad
doll	golly	goll	goll
kite	gite	gite	gite
top	cop	cop	cop
dog	goggy	gog	gog
lamb	amb	amm	amba
duck	guck	guck	guck
boat	coat	coat	coat
swing	twing	twing	twing
car	gar	gar	gar
goat	coat	cot	coat
rooster	rooker	rooker	rooker
calf	taff	taffy	taff

Post discrimination training test

Stimulus	Response					
Trial	1	2	3	4	5	6
cat	tat	tiddy	tat	tat	tat	tat
doll	golly	goll	golly	golly	goll	goll
kite	gite	gite	gite	gite	gite	gite
top	cop	gop	cop	cop	cop	cop
dog	gog	goggy	goggy	gog	gog	gog
lamb	lamb	amby	lamb	lamb	lamb	lamb
duck	guck	guck	guck	guck	guck	guck
boat	coat	coat	coat	coat	coat	coat
swing	twing	twing	twing	ping	twing	twing
car	gar	gar	gar	gar	gar	gar
goat	coat	coat	coat	coat	coat	coat
calf	taff	taffy	tafts	taff	taff	taff


Percent Correct
100
90
80
70
60
50
40
0
Session Number
1 2 3
Auditory only same-different
4 5 6 7
Visual only match to sample
8 9 10 11
Visual only same-different
12 13 14
Visual plus auditory same-diff.
15
Audit. only same-diff.
16 17 18 19 20 21 22 23 24 25
Visual plus auditory same-different
26 27 28 29
Auditory only same-different